AMERICAN LEADERSHIP IN BIOTECHNOLOGY

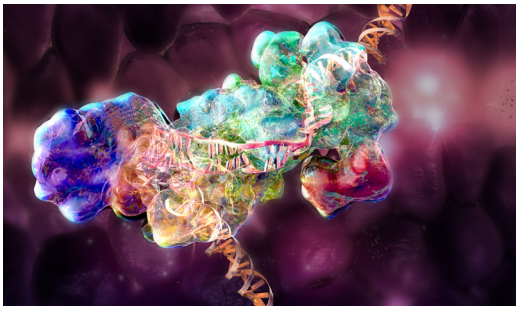
Advancements in biotechnology are transforming our world and enabling everything from life-saving vaccines to everyday products like food and biofuels. Combining the power of engineering with the evolutionary knowledge of nature, these innovations grow the U.S. economy and help address important challenges in health care, agriculture, manufacturing and energy. The U.S. National Science Foundation is driving fundamental research to advance the bio-industries of the future and to accelerate new biotechnologies that will benefit science and society.

U.S. LEADERSHIP IN THE BIOECONOMY

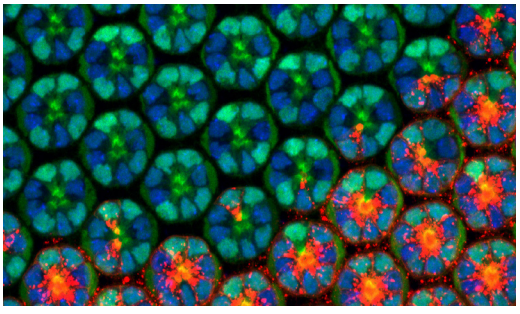
America's leadership in the emerging bioeconomy is increasingly vital to U.S. global competitiveness, security, and economic growth. Through strategic investments in basic research, technology translation, research infrastructure and training, NSF is working to secure America's standing in bioeconomy now and well into the future.

SEEDING BIOTECH BREAKTHROUGHS

NSF has supported discoveries in biotechnology for decades, leading to development of new polymers, green fluorescent proteins and techniques that enabled the rapid sequencing and identification of SARS-CoV-2. NSF support has also helped to accelerate COVID-19 diagnostics, antibody therapeutics and delivery of a COVID-19 vaccine. In the 1980s, NSF invested in new fields in molecular biotechnology through the flagship Science and Technology Centers program and in tissue engineering through the Engineering Research Centers program. The agency continues to support pioneering work in cellular construction, biomechanics, cryopreservation, and cell manufacturing through these programs.



In the early 2000s, NSF became the first federal agency to invest in a synthetic biology research center. The training and collaborative opportunities provided radically transformed the field and included for the first time an emphasis on ethical and socially responsible development of this new technology.



FAST FACTS

$250M
Amount NSF invests annually to support advancements in biotechnology and the bioeconomy.

20
Number of current research centers and institutes across NSF that support advances in biotechnology and advance the bioeconomy.

$6.7M
Amount NSF invested in the first year of its Future Manufacturing program to support biotechnology innovations that overcome barriers to new biomanufacturing techniques.

1993
Year NSF launched its Advanced Technical Education program to prepare undergraduate students for careers in advanced technologies, including biotechnology.

50 days
Length of time the vessel affiliated with NSF's Marine Bioproducts Engineering Center can host researchers studying remote ocean locations for bioresources.

UNDERSTANDING THE RULES OF LIFE

Fundamental biological research is the engine driving growth across all bioeconomic sectors. New investments within NSF's Understanding the Rules of Life Big Idea build on this foundation to better understand and predict, control and ultimately design how living systems function. Additionally, programs including the Biology Integration Institutes, Plant Genome Research Program, and Enabling Discovery through GEnomics support investigations to understand life's innovations. Working across disciplines and sectors, and reaching into extreme Earth, sea, and polar environments to understand biological adaptations, these programs enable new integrative research tools and infrastructure.

CREATING NEXT-GENERATION TECHNOLOGIES

NSF supports cross-cutting advances in biology, chemistry, computing, engineering, geosciences, materials science, mathematics, physics, and social and economic sciences to accelerate biotechnologies, drive innovation and foster economic growth.

NSF's partnership with the Simons Foundation established four research centers that have brought mathematical perspectives to future bio-applications, including new cell-based therapies or strategies for responding to climate change.

NSF is pushing the frontiers in fields such as synthetic biology, chemical biology, gene synthesis and bioengineering through programs such as Designing Synthetic Cells Beyond the Bounds of Evolution, Reproducible Cells and Organoids via Directed- Differentiation Encoding, Molecular Foundations for Biotechnology Initiative, Plant Synthetic Biology and Semiconductor Synthetic Biology for Information Storage and Retrieval.

The Center for Genetically-Encoded Materials is redirecting nature's protein translation apparatus to generate non-natural polymers as new synbio-plastics, and the BioPolymers, Automated Cellular Infrastructure, Flow, and Integrated Chemistry: Materials Innovation Platform is using biological systems to produce synbio-plastic building blocks.

NSF's Future Manufacturing program lays the groundwork for a new generation of industries. Through the program's investment in biomanufacturing research, NSF is supporting new methods for manufacturing cell-based therapies, DNA-based electronics, and functional microstructures for the delivery of biologics, as well as methods for understanding and engineering biological systems that facilitate assembly and reuse of building materials.

TRAINING THE BIO-WORKFORCE OF TOMORROW

NSF invests in strategic educational and experiential programs to expand and nurture the biomanufacturing workforce, such as the InnovATE BIO National Biotechnology Center at Austin Community College, the Advanced Technical Education program, and the Postdoctoral Research Fellowships in Biology, or PRFB, program, which includes tracks in plant genomics and rules of life research. NSF also fosters innovative thinking and practices through entrepreneurship training and non-academic professional development experiences like the Innovation Corps, or I-Corps™ program, Partnerships for Innovation program, and research internships for graduate students in non-academic organizations.

To support broader participation in STEM, NSF invests in efforts such as the Innovative Technology Experiences for Students and Teachers, or ITEST, that supports new approaches to prepare K-12 learners for the Industries of the Future, including biotechnology. One ITEST effort, Biotech Partners, pairs high school students from underrepresented groups in STEM with mentors from bioscience industries through its Biotech Academy. In addition, the PRFB program contains a broadening participation track that engages individuals underrepresented in STEM.

SPURRING STARTUPS

America's Seed Fund, powered by NSF's Small Business Innovation Research and Small Business Technology Transfer programs, enables startups and small businesses to transform discovery into impact through new commercial and societal solutions.

DID YOU KNOW?

For nearly three decades, NSF has supported the work of Frances H. Arnold, recipient of the **2018 Nobel Prize** in **chemistry** on the directed evolution of enzymes. NSF has also long supported the research of Jennifer Doudna, the recipient of the **2020 Nobel Prize in chemistry** on bacterial innate immunity.